Assessment

Forest Plan Revision

Draft Air Resources Report

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for:
Custer Gallatin National Forest

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Contents

Introduction

Air quality is one of the many resources the Forest Service must monitor and protect on its public lands. Air is an important resource not only because it provides life to nearly all living organisms, but also because pollutants in the air can deposit onto landscapes at levels that negatively affect water quality and ecosystem function (examples are algal blooms, mercury build-up in fish tissues, or the extirpation of rare and sensitive plants). In addition, people benefit from clean air and clear views found on national forest lands.

Process and Methods

The 2012 Planning Rule mandates national forests and grasslands to undergo an assessment of each resource. The purpose of the air quality assessment is to report and evaluate available information about air quality. This assessment is based on the best available scientific information including peer-reviewed journal articles; Forest Service publications; state (Montana and South Dakota) and Federal statutes, laws, and regulations; and personal communication with air quality specialists. Best available scientific information used is cited in the "Literature Cited" section.

This assessment will:

- Outline the Federal and state regulatory framework for addressing air quality, including the relevant Federal and state agency implementation plans;
- Identify airsheds relevant to the plan area and include sensitive air quality areas such as class I areas, nonattainment areas, and maintenance areas;
- Identify emission inventories, conditions, and trends within relevant airsheds;
- Identify monitoring programs in and around the plan area;
- Address and identify critical loads and the extent and severity of any exceedances; and
- Document current conditions and trends of relevant airsheds assuming existing plan direction remains in place.

Regulatory Framework

Federal Clean Air Act

The 1970 Clean Air Act (www.epa.gov/air/caa/title1.html), as amended in 1977 and 1990 (42 U.S.C. §7401 et seq.) provides the foundation for protections of clean air on Federal lands. The 1977 Clean Air Act amendments direct Federal land managers to "preserve, protect, and enhance the air quality" in 156 mandatory class I national parks and wilderness areas (42 U.S.C. 7470 et seq.). Class I areas are wilderness areas that were designated before August 7, 1977, and are larger than 5,000 acres. All other land managed by Federal land managers are designated class II.

Under the Clean Air Act Federal agencies including the Forest Service are held responsible to protect air quality related values in class I areas.

The Custer Gallatin National Forest does not manage any class I airsheds. However, there are two class II wilderness areas and one wilderness study area which the Forest may choose to uphold to class I air quality standards: Absaroka-Beartooth Wilderness, Lee-Metcalf Wilderness, Hyalite/Porcupine-Buffalo Horn Wilderness Study Area.

Yellowstone National Park and the Northern Cheyenne Reservation are both class I airsheds in close proximity to the Custer Gallatin.

National Ambient Air Quality Standards (40 CFR part 50)

Under the Clean Air Act, national ambient air quality standards were established (40 CFR part 50). National ambient air quality standards identified six criteria pollutants and established standards for each that must be met by state and Federal agencies and private industry (Table 1). Criteria pollutants include carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter ($PM_{2.5}$ and PM_{10}), and sulfur dioxide. Standards include primary and secondary. Primary standards are designed to provide protection to public health; whereas secondary standards are designed to protect against damage to animals, crops, vegetation, and buildings, and against decreased visibility.

The current national ambient air quality standards are found in Table 1.

Conformity Determinations

The general conformity provisions of the Clean Air Act (section 176(c)) prohibits Federal agencies from taking any action within a non-attainment area that causes or contributes to a new or existing violation of the standards or delays the attainment of a standard.

Regional Haze Rule (40 CFR Part 51)

Haze is created when sunlight hits and is either absorbed or scattered by air pollution particles. EPA's 1980 visibility rules (40 CFR 51.301-307) were developed to protect mandatory class I areas from anthropogenic impairments attributable to a single or small group of sources. In 1988, EPA and other agencies began monitoring visibility in class I areas.

The 1999 Regional Haze Rule (40 CFR 51.308-309) called for states to establish goals to improve visibility in 156 national parks and wilderness class I areas and to develop long-term strategies to reduce the emissions of air pollutants that cause visibility impairment. The Regional Haze regulations apply to all states, and require states to demonstrate reasonable progress for improving visibility in each class I area over a 60-year period (to 2064), during which visibility should be returned to natural conditions.

The Interim Air Quality Policy on Wildland and Prescribed Fires (U.S. EPA 1998)

On May 15, 1998, the EPA issued the Interim Air Quality Policy of Wildland and Prescribed Fire to address impacts to public health and welfare (EPA 1998). The goal of the Interim Policy is to allow fire to function in an ecological role to help maintain healthy ecosystems while balancing the need to protect public health and welfare from the impacts of fire-related air pollution emissions. The Interim Policy is interim because it does not yet address agricultural burning or regional haze (EPA 1998).

The Interim Policy suggests that air quality and visibility impact evaluations of fire activities on Federal lands should consider several different items during planning (EPA 1998). In a project-level NEPA document it is appropriate to consider and address to the extent practical, a description of applicable regulations, plans, or policies, identification of sensitive areas (receptors), and the potential for smoke intrusions in those sensitive areas. Other important disclosure items include applicable smoke management techniques, participation in a basic smoke management program, and potential for emission reductions.

Ambient air quality and visibility monitoring (for class I areas) are typically done collaboratively with the states. Impacts to regional and sub-regional air are addressed operationally through a coordinated smoke management program. The EPA urges states to develop, implement, and certify smoke management programs that meet the recommended requirements of the Interim Policy. In accordance with the Interim Policy, the State of Montana has implemented a certified smoke management program. This program is administered through the Montana/Idaho Airshed Group (www.smokemu.org). Member burners of the Montana/Idaho Airshed Group (including the Forest Service) submit burn requests to the Smoke Monitoring Unit, which coordinates and approves prescribed burning activities in a manner designed to meet ambient air quality standards.

The Wilderness Act (16 U.S.C. 1131-1136)

The Wilderness Act of 1964 mandates that wilderness areas be preserved for wilderness character and managed preserve and protect natural wilderness conditions (16 U.S.C. 1131-1136).

The Wilderness Act requires wilderness areas (class I and II) to be administered “for the use of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness.” While class II wilderness areas are protected by the Wilderness Act, class I areas have additional protections under the Clean Air Act. The Wilderness Act does not protect wilderness study areas or research natural areas.

National Forest Management Act (16 U.S.C. 1600-1614)

Under the National Forest Management Act of 1976, national forests and grasslands must create land management plans. The law states “National Forests are ecosystems and their management….requires awareness and consideration of the interrelationships among plants, animals, soil, water, air, and other environmental factors within such ecosystems” (16 U.S.C. 1600-1614).

National Environmental Policy Act (NEPA) (42 U.S.C. 4321-4346)

The National Environmental Policy Act requires national forests and grasslands to examine the environmental consequences of major proposed Federal actions. The decision making process must incorporate public input (42 U.S.C. 4321-4346).

State Level Direction and Regulations

State Implementation Plans

Each state is required under the Clean Air Act to have an EPA-approved state implementation plan (section 110(a)(2)) which identifies a strategy to maintain or attain national ambient air quality standards (section 110(h)(1)). The Montana State Implementation Plan was approved by EPA and promulgated through the Montana Clean Air Act and implementing regulations to provide specific guidance on maintenance of air quality, including restrictions on open burning (ARM 16.8.1300). The Montana Department of Environmental Quality and the South Dakota Department of Environment and Natural Resources have the regulatory authority to implement and enforce air quality in Montana and South Dakota respectively, at a standard equal to or more stringent than EPA Federal standards.

Table 1 shows Federal and Montana Ambient Air Quality Standards. South Dakota’s uses national ambient air quality standards as their ambient air quality standards.

Table 1. U.S. EPA National Ambient Air Quality Standards and Montana Ambient Air Quality Standards

Pollutant	Averaging Period	Federal Standards	State of Montana Standards	Federal Standard Type
Carbon Monoxide	1-Hour	35 ppm [a]	23 ppm [b]	Primary
	8-Hour	9 ppm [a]	9 ppm [b]	Primary
Lead	Quarterly	1.5 $\mu g/m^3$ [c, o]	1.5 $\mu g/m^3$ [c]	NA
	Rolling 3-Month	0.15 $\mu g/m^3$ [c]	NA	Primary & Secondary
Nitrogen Dioxide	1-Hour	100 ppb [d]	0.30 ppm [b]	Primary
	Annual	53 ppb [e]	0.05 ppm [f]	Primary & Secondary
Ozone	1-Hour	NA [g]	0.10 ppm [b]	Primary & Secondary
	8-Hour	0.070 ppm [h] (2015 standard)	NA	Primary & Secondary
Particulate Matter ≤ 10 µm (PM_{10})	24-Hour	150 $\mu g/m^3$ [j]	150 $\mu g/m^3$ [j]	Primary & Secondary
	Annual	NA	50 $\mu g/m^3$ [k]	Primary & Secondary
Particulate Matter ≤ 2.5 µm ($PM_{2.5}$)	24-Hour	35 $\mu g/m^3$ [l]	NA	Primary & Secondary
	Annual	12.0 $\mu g/m^3$ [m]	NA	Primary
	Annual	15.0 $\mu g/m^3$ [m]	NA	Secondary
Sulfur Dioxide	1-Hour	75 ppb [n]	0.50 ppm [p]	Primary
	3-Hour	0.5 ppm [a]	NA	Secondary
	24-Hour	0.14 ppm [a, q]	0.10 ppm [b]	Primary
	Annual	0.030 ppm [e, q]	0.02 ppm [f]	Primary
Visibility	Annual	NA	$3 \times 10^{-5}/m$ [f]	NA

Note: South Dakota ambient air quality standards are the same as the national ambient air quality standards.

a. Federal violation when exceeded more than once per calendar year.

b. State violation when exceeded more than once over any 12-consecutive months.

c. Not to be exceeded (ever) for the averaging time period as described in either state or Federal regulation. Pb is a 3-year assessment period for attainment.

d. Federal violation when 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitoring site exceeds the standard.

e. Federal violation when the annual arithmetic mean concentration for a calendar year exceeds the standard.

f. State violation when the arithmetic average over any four consecutive quarters exceeds the standard.

g. Applies only to nonattainment areas designated before the 8-hour standard was approved in July 1997. Montana has none.

h. Federal violation when 3-year average of the annual 4th-highest daily maximum 8-hour concentration exceeds standard (October 26, 2015).

i. To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm. The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard. EPA is in the process of reconsidering these standards (set in March 2008).

j. State and Federal violation when more than one expected exceedance per calendar year, averaged over 3 years.

k. State violation when the 3-year average of the arithmetic means over a calendar year at each monitoring site exceed the standard.

l. Federal violation when 3-year average of the 98th percentile 24-hour concentrations at each monitoring site exceed the standard.

m. Federal violation when 3-year average of the annual mean at each monitoring site exceeds the standard.

n. Federal violation when 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitoring site exceeds the standard. Promulgated June 2, 2010. Expected effective date mid-August 2010.

o. The 1978 lead national ambient air quality standards will remain effective until 1 year after designations are effective for the October 15, 2008; revised lead national ambient air quality standard (0.15 $\mu g/m^3$), except in existing lead nonattainment areas (East Helena, Montana). In East Helena, EPA will retain the 1978 lead national ambient air quality standard until EPA approves attainment and/or maintenance demonstrations for the revised lead national ambient air quality standard.

p. State violation when exceeded more than 18 times in any 12 consecutive months.

Montana Code Annotated (Title 75. Environmental Protection)

The Clean Air Act of Montana, chapter 2 "Air Quality" provides state regulatory requirements and outlines intent, limitations, and powers associated to the regulatory agency within the State of Montana.

Administrative Rules of Montana (ARM) (Title 17, Chapter 8, Subchapter 6)

This rule covers the general provisions of open burning including definitions, restrictions on non-burnable material, and major/minor burner requirements.

Smoke Management

Smoke management plans have been developed for many states with the purpose to manage and control smoke from prescribed fire and burns. The goal is to minimize smoke in populated areas, prevent public safety hazards, avoid violations of the national ambient air quality standards, and to avoid visibility impacts in class I areas.

In Montana, the Forest Service is considered a major open burner (any entity that emits more than 500 tons of carbon monoxide or 50 tons of any other regulated pollutant per calendar year), and conducts prescribed burning under the provisions of an annual open burning permit issued by Montana Department of Environmental Quality (http://deq.mt.gov/AirQuality/OpenBurn/2015/USDAForestService.pdf).

The Custer Gallatin National Forest is a member of the Montana/Idaho Airshed Group (www.smokemu.org). Any prescribed burning in Montana must follow the guidelines established in the Montana/Idaho Airshed Group's Operating Guide (http://smokemu.org/docs/2010%20Operations%20Guide.pdf). Planned permitted burns will be submitted to the smoke monitoring unit in Missoula, Montana. For each burn planned, the type of burn, the number of acres to burn, location and elevation of each site will be provided to the smoke monitoring unit. The Montana/Idaho Airshed Group Smoke Program Coordinator will use the burn information, along with meteorological forecasts, to recommend burn restrictions for airsheds with planned burning. The smoke monitoring unit issues daily burn recommendations for airsheds, elevations, or impact zones on the Montana/Idaho Airshed Group Website.

The Custer Gallatin National Forest will also comply with open burning guidelines of South Dakota's Department of Environment and Natural Resources (34A-1-18). The guidelines for open burning in South Dakota can be found at: http://denr.sd.gov/des/aq/openburn.aspx.

Geographic Boundaries—Air Sheds

The Custer Gallatin National Forest falls in four airsheds defined by the Montana/Idaho Airshed Group: 7, 8A, 8B, and 10 for managing smoke from prescribed burns (Montana/Idaho Airshed Group Operating Guide 2010) (Figure 1). The state of South Dakota does not have any special guidelines specific to burning on Forest Service land and the state is not broken up into different airsheds. All of the Custer Gallatin National Forest in South Dakota is located in Harding County.

Because air does not follow boundaries and can come from local and long distance sources covering vast landscapes, this document discusses air quality across the whole Custer Gallatin National Forest except when discussing smoke from prescribed burns which falls into airsheds previously mentioned.

Figure 1. Montana air sheds

Note: The Custer Gallatin National Forest falls in air sheds 8A, 8B, and 10. South Dakota is not broken up into airsheds. Figure curtesy of NRCS (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mt/home/?cid=nrcs144p2_056477)

Existing Information Sources

This assessment is based on the best available scientific information including peer-reviewed journal articles; Forest Service publications; state (Montana and South Dakota) and Federal statutes, laws, and regulations; and personal communication with air quality specialists. Best available scientific information used is cited throughout the assessment and included in the "Literature Cited" section.

Journal articles used have undergone a peer-review process from the scientific community as well as scrutiny from air quality specialists. The U.S. Forest Service is not a regulatory agency and must abide by the laws and regulations set forth by Federal (Environmental Protection Agency) and State (Montana Department of Environmental Quality and South Dakota Department of Environment and Natural Resources). Forest Service publications include direction on smoke management which is a collaboration with the state agencies.

Current Forest Plan Direction

Both the Custer and Gallatin National Forests will cooperate and abide by Federal and state laws to protect air quality on Forest Service lands whenever the agency has the authority to do what is required (see the "Regulatory Framework" section) and will cooperate with states, other agencies, and organizations in identifying, evaluating, proposing solutions, and monitoring air quality problems associated with activities permitted on national forest and national grassland surfaces including (from the Custer Forest Plan) impacts to air quality and loss of energy resources due to the flaring of gas from oil wells. Generally, the Forest Service recommendation will be to only allow flaring during production testing of wells and to require either connection to a pipeline or reinjection once production is established. Exceptions would be considered in some situations such as where low volumes of gas are being produced and where there is a limited or no opportunity to connect to a pipeline or to reinject.

The objective is to maintain air quality at or above levels required by Federal and state laws, regulations, and standards. The objective for visibility is preservation. Air that passes over National Forest System lands will not be degraded below allowable increments by activities under Forest Service control. State and local governments and appropriate Federal agencies will also be consulted and involved in monitoring and controlling air pollution originating on non-Federal lands and affecting air quality on Federal lands.

Smoke Management Plans will be followed.

The Absaroka -Beartooth Wilderness has been recommended for class I air quality standards under the Clean Air Act.

Existing Condition

State Emissions

Counties

The Custer Gallatin National Forest has land in the following counties: Park, Gallatin, Sweet Grass, Madison, Carbon, Meagher, Powder River, Stillwater, Rosebud, Carter, and Harding (South Dakota) Counties (Figure 2).

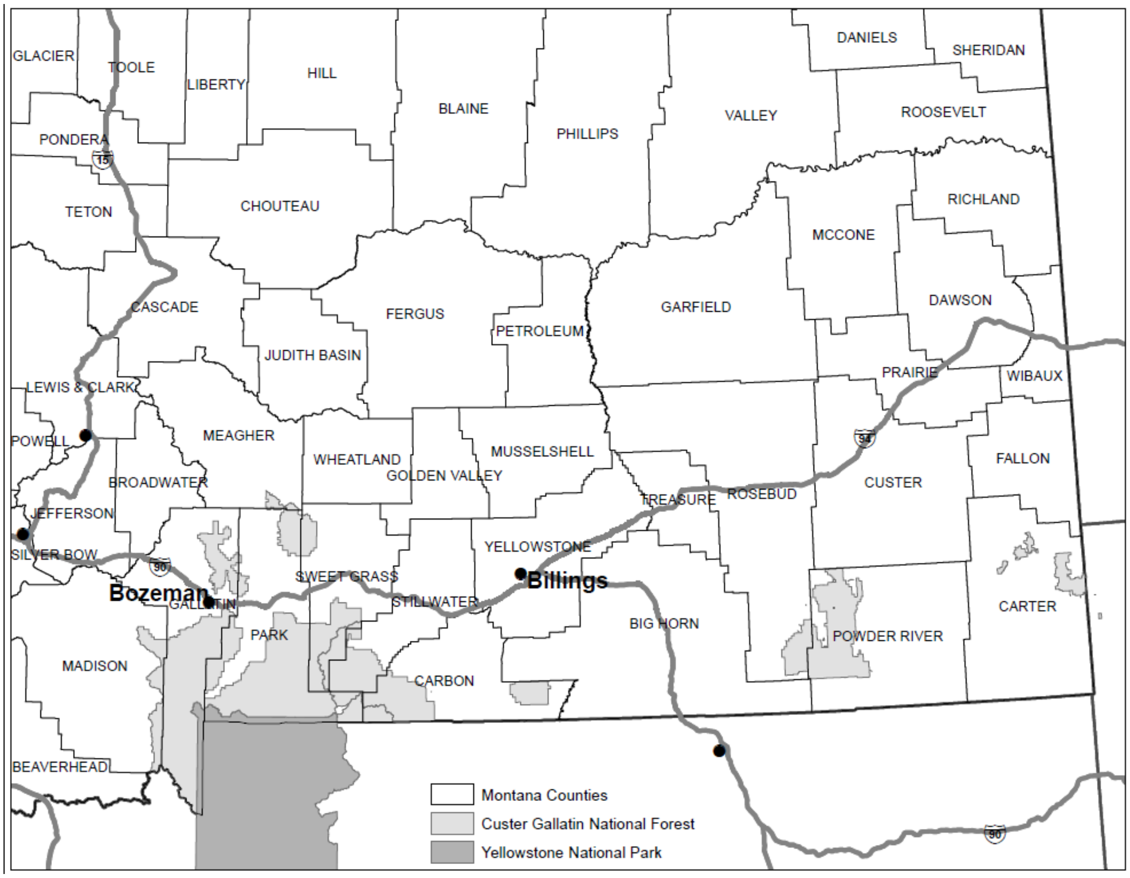

Figure 2. Custer Gallatin National Forest (light grey) and counties in Montana

Note: A small portion of the Custer Gallatin National Forest lies in Harding County, South Dakota, just east of Carter County, Montana.

Emission Inventories

The EPA requires each state and local air agencies to report emissions of criteria pollutants and their precursors to the National Emission Inventory database. The National Emission Inventory is prepared and released online every 3 years. The latest available data at the time of this report was for 2011 http://www3.epa.gov/ttn/chief/net/2011inventory.html.

In 2011 Powder River County had the highest annual emissions for particulate matter (10 and 2.5), carbon monoxide (CO) and ammonia (NH_3). Rosebud County had the highest annual emissions for nitrogen oxide (NOx) and sulfur dioxide (SO_2). Both Powder River and Rosebud County are located on the eastern side of the Custer Gallatin National Forest (Table 2).

Table 2. 2011 National Emission Inventory by counties in Montana and South Dakota that contain part of the Custer Gallatin National Forest (emissions are in tons/year)

County	PM_{10}	$PM_{2.5}$	SO_2	CO	NO_x	NH_3
Carbon	7,311.62	2,325.30	136.05	22,594.22	1,090.17	1,003.25
Carter	1,947.18	669.25	27.73	5,818.52	218.26	1,154.57
Gallatin	16,606.80	2,666.62	94.11	24,625.11	3,844.53	1,266.98
Madison	4,417.71	806.97	24.07	5,234.82	501.78	801.52
Meagher	1,935.89	766.50	51.10	7,408.13	259.91	514.70
Park	5,126.07	1,491.78	86.05	15,618.84	1,521.60	688.80
Powder River	33,785.69	27,268.53	1,857.63	331,159.96	2,787.76	6,256.82
Rosebud	15,534.87	6,950.07	12,660.48	54,267.17	17,676.78	1,702.83
Stillwater	6,992.59	1,117.29	30.49	5,867.58	1,493.13	1,031.25
Sweet Grass	3,161.38	812.89	40.34	7,915.19	1,258.99	570.27
Harding (South Dakota)	1,108.05	268.64	15.84	1,865.85	417.98	14,26.20

In general, the predominant winds in central Montana come from the west and southwest (Figure 3). Wind direction and speed is important to air quality because it can help pinpoint where sources of pollution may be coming from. The Custer Gallatin National Forest is made up of complex mountainous terrain which can affect local wind patterns.

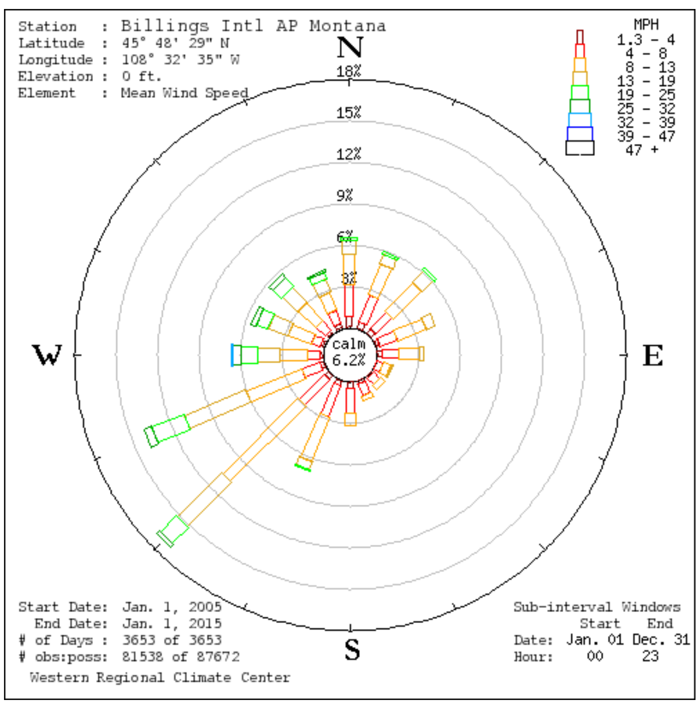

Figure 3. Wind rose from the Billings International Airport in Montana showing average wind direction and speed from 2005–2015

Sensitive Air Quality Areas

Class I wilderness areas are managed in accordance with the Clean Air Act and Wilderness Act. Non-class I wilderness areas are considered class II areas and are managed consistent with the Wilderness Act. Non-wilderness class II areas are managed according to multiple use objectives (such as habitat protection, recreation, and forest products) in accordance with forest management plans.

There are no class I areas managed by the Custer Gallatin National Forest. However, Yellowstone National Park and the Northern Cheyenne Reservation are both class I areas in close proximity to the Custer Gallatin. The Lee Metcalf Wilderness and the Absaroka-Beartooth Wilderness are both class II wilderness areas within the Custer Gallatin National Forest and are protected by the Wilderness Act. The Hyalite/Porcupine-Buffalo Horn Wilderness Study Area is not protected under the Wilderness Act, but is still considered a sensitive air quality area.

The Custer Gallatin National Forest has numerous research natural areas and may choose to hold these areas to a higher air quality standard through the National Forest Management Act.

East Side:

- Lost Water Canyon (Beartooth Ranger District, Pryor Mountains)
- Line Creek (Beartooth Ranger District, Beartooth Mountains)
- Poker Jim (Ashland Ranger District)
- Deer Draw (Sioux Ranger District, Slim Buttes Unit)

West Side:

- Black Butte (Hebgen Lake Ranger District, inside the Monument Mountain unit of the Lee Metcalf Wilderness)
- East Fork Mill Creek (Yellowstone Ranger District, inside the Absaroka-Beartooth Wilderness)
- Moose Creek Plateau (Hebgen Lake Ranger District, a sliver is on the Custer Gallatin National Forest, mostly in Idaho)
- Obsidian Sands (Hebgen Lake Ranger District)
- Palace Butte (Bozeman Ranger District, up Hyalite)
- Wheeler Ridge (Bozeman Ranger District, up South Cottonwood)
- Passage Creek (Yellowstone Ranger District, about half of it is in the Absaroka-Beartooth Wilderness)
- Sliding Mountain (Yellowstone Ranger District, inside the Absaroka-Beartooth Wilderness)
- Targhee Creek (Hebgen Lake Ranger District, again just a sliver on the Custer Gallatin National Forest, mostly in Idaho)

There is one smoke impact zone on the Custer Gallatin identified by the Montana/Idaho Airshed group; Big Sky, Montana, which falls in airshed 8A. Proximity of the impact zone is considered for any burn recommendations.

Nonattainment Areas

Forest Service land that falls within nonattainment areas are subject to Conformity Determinations of the Clean Air Act (section 176(c))—meaning every Forest Service action that produces non-mobile air pollutants must be evaluated for its effect on the nonattainment area.

The whole state of South Dakota is in attainment. No portion of the Custer Gallatin National Forest lies within a nonattainment area; however, there are a few nonattainment areas in close proximity (as of October 1, 2015 https://www3.epa.gov/airquality/greenbook/). Lame Deer in Rosebud County is in marginal nonattainment for PM_{10}. Billings and the greater Laurel area in Yellowstone County are both in nonattainment for sulfur dioxide.

Monitoring Programs

Air quality monitoring in and around the Custer Gallatin National Forest is conducted by national, state, and local programs. The two primary national monitoring programs are: Interagency Monitoring of Protected Visual Environments (IMPROVE) and National Atmospheric Deposition Program (NADP). The EPA mandates each state to establish a network of monitors that measure ambient air concentrations of criteria pollutants (40 CFR Part 58). This monitoring network is known as SLAMS (State and Local Air Monitoring Stations). States also have special purpose monitors (SPMs) that are not part of the SLAMs network. The Custer Gallatin National Forest uses IMPROVE and NADP data to assess air quality conditions on Forest Service land. Visibility measured by IMPROVE and precipitation measured by NADP are part of the Air Quality Related Values (AQRVs) monitored across the Forest to keep track of overall air quality (Table 3). Other AQRVs measured directly by the Forest Service are lichens and lake water chemistry. The Custer Gallatin National Forest works as a cooperator with the United States Geological Survey (USGS) to help sample snowpack chemistry each year at selected sites. The Custer Gallatin National Forest intermittently partners with universities and researchers to gain and expand knowledge about air pollution.

Table 3. Shows the wilderness areas, their class rating, the air quality-related values that are monitored, and the laws that protect them

Wilderness	Air Quality-Related Values	Laws
Absaroka-Beartooth (Class II)	Long-term lake water chemistry, lichens, visibility, snowpack chemistry	Wilderness Act
Lee Metcalf (Class II)	Lichens, snowpack chemistry, synoptic lake sampling	Wilderness Act
Porcupine-Buffalo Horn Wilderness Study Area (Class II)	Lichens	Forest Management Act
Yellowstone National Park (Class I)	Visibility, NADP precipitation chemistry, snowpack chemistry, climate	Clean Air Act, Wilderness Act
Northern Cheyenne Reservations (Class I)		Clean Air Act

The IMPROVE Program

The Interagency Monitoring of Protected Visual Environments (IMPROVE) is a national program that started in 1985 to establish baseline conditions and monitor visibility in 156 class I areas as mandated from the 1977 amendments to the Clean Air Act. IMPROVE monitoring also serves as a marker to assess progress toward the national visibility goal of no manmade impairment in support of the Regional Haze Rule. IMPROVE monitors sample ambient air with samples collected every Tuesday throughout the calendar year. More information about the IMPROVE program including data can be found at http://vista.cira.colostate.edu/improve/.

There are two IMPROVE monitors in the vicinity of the Custer Gallatin National Forest. One is in Yellowstone National Park (YELL2). The original site established in 1988 was known as YELL1, but was moved a mile to its current site (YELL2) in 1996 due to problems with dust. The second monitor is the North Absaroka monitor (NOAB1) on top of Dead Indian Pass northwest of Cody, Wyoming. Grenon (et al. 2010) analyzed trends at YELL 1 and 2 in ammonium sulfate, ammonium nitrate, organic mass carbon, elemental carbon, fine soil, coarse mass, sea salt, deciview, visual range, and the sum of aerosol extinctions. Deciview (dv) is a haze index that is derived from calculated light extinction measurements. Deciview decreases as the standard visual range increases.

Analyzed data found an increase in visibility (visual range) at YELL2 IMPROVE site due to annual decreasing trends in elemental carbon, fine soil, and coarse mass. No annual or seasonal trends ($p<0.05$) were found with ammonium sulfate and ammonium nitrate (Grenon et al. 2010).

New research is looking at the 20 percent most impaired (highest fraction of haze) days of anthropogenic sources and excluding natural sources such as wildland fires (Copeland 2015). Data plotted with this new method show an increase in visibility (decrease in deciview) at both the NOAB1 and YELL 2 IMPROVE sites between 2004 and 2014 (Figure 4 and Figure 5).

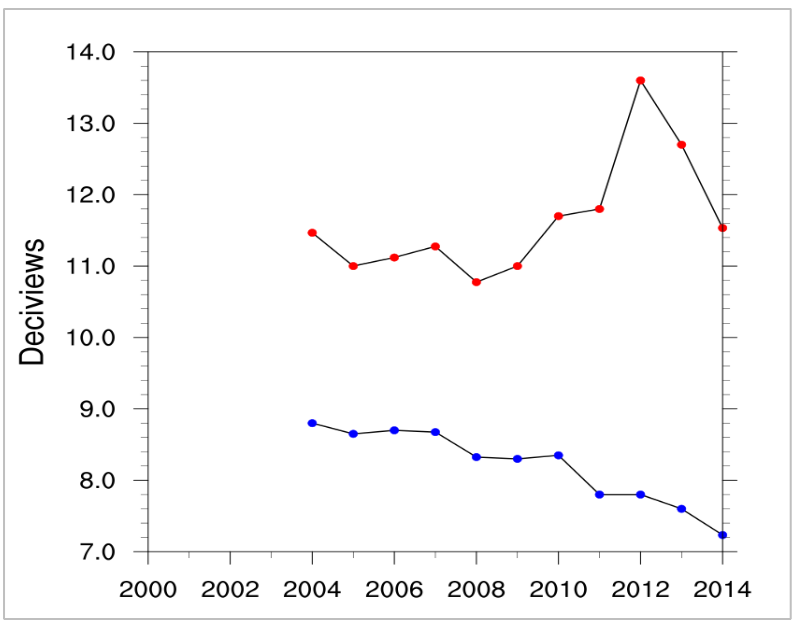

Figure 4. NOAB1 IMPROVE monitoring station

Note: Red dots equal the total haze on the 20 percent haziest days, using the old method of including human-caused and natural emissions. Blue dots equal the total haze on 20 percent most impaired days, the new method which includes the highest fraction of haze attributed to human-caused sources and excluding natural sources such as wildland fire. The lines represent 5 year averages.

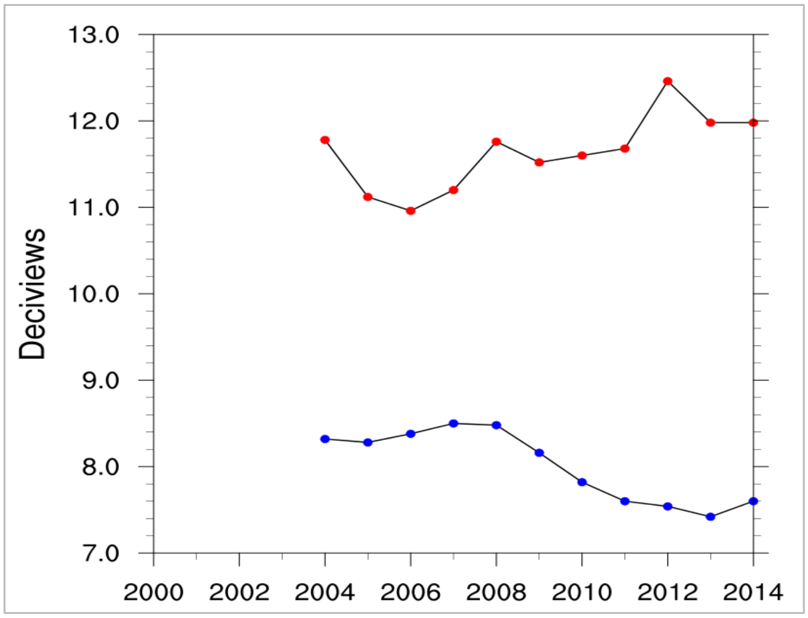

Figure 5. YELL2 IMPROVE monitoring station

Note: Red dots equal the total haze on the 20 percent haziest days, using the old method of including human-caused and natural emissions. Blue dots equal the total haze on 20 percent most impaired days, the new method which includes the highest fraction of haze attributed to human-caused sources and excluding natural sources such as wildland fire. The lines represent 5 year averages.

National Atmospheric Deposition Program

The National Atmospheric Deposition Program (NADP) was started in 1978 with the primary purpose to monitor acid rain. The program measures precipitation chemistry (both rain and snow) and total precipitation at numerous sites across the country. Samples are collected every Tuesday throughout the calendar year. Data and sampling protocols can be found at http://nadp.isws.illinois.edu/.

There are two NADP sites relevant to the Custer Gallatin National Forest, Tower Falls (WY08) in Yellowstone National Park and Little Bighorn (MT00) at the Little Bighorn Battlefield National Monument, Montana. WY08 was started in 1980 and MT00 was started in 1984. Analyzed NADP data between start dates and 2006 found annual ammonium concentrations in precipitation had increased significantly while sulfate concentrations had decreased significantly at both the MT00 and WY08 sites. Nitrate concentrations had increased at the WY08 site (Grenon and Story 2009).

Though, statistical analysis has not been rerun, the trend graphs for MT00 and WY08 through 2014 are shown below (figures 6 through 13).

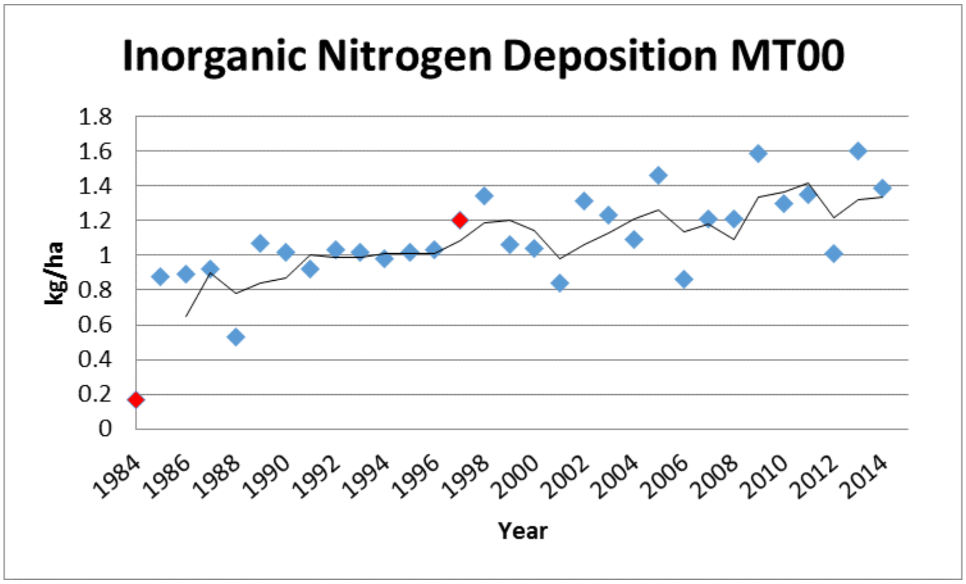

Figure 6. Inorganic wet nitrogen deposition at Little Bighorn battlefield NADP site

Note: Trend line follows the 3-year average and red diamonds equal years where the annual weighted mean depositions do not meet the NADP data completeness criteria.

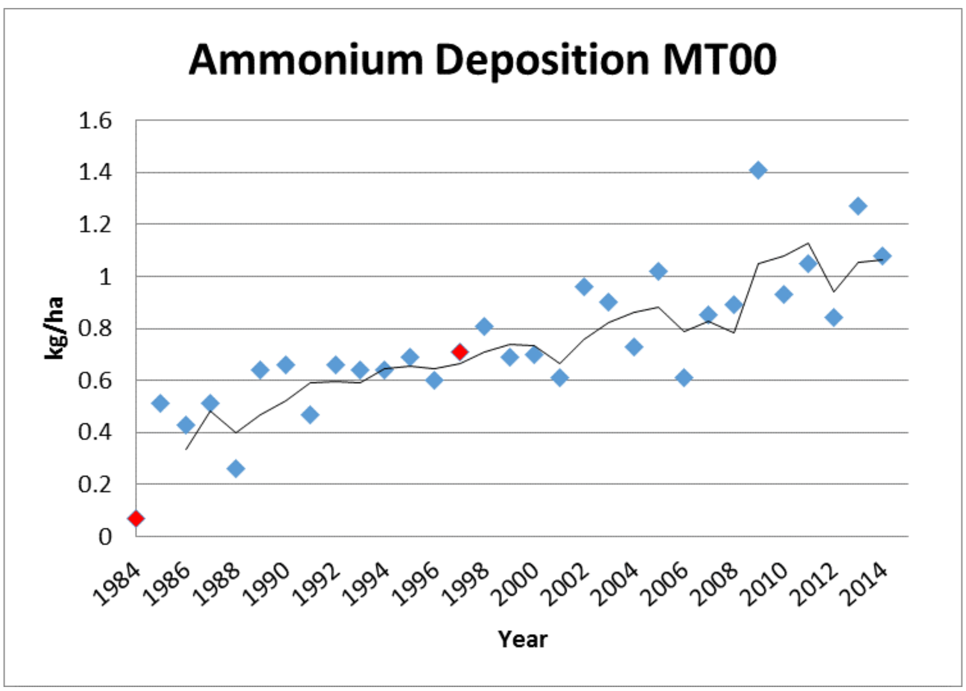

Figure 7. Ammonium wet deposition at Little Bighorn battlefield NADP site

Note: Trend line follows the 3-year average and red diamonds equal years where the annual weighted mean depositions do not meet the NADP data completeness criteria.

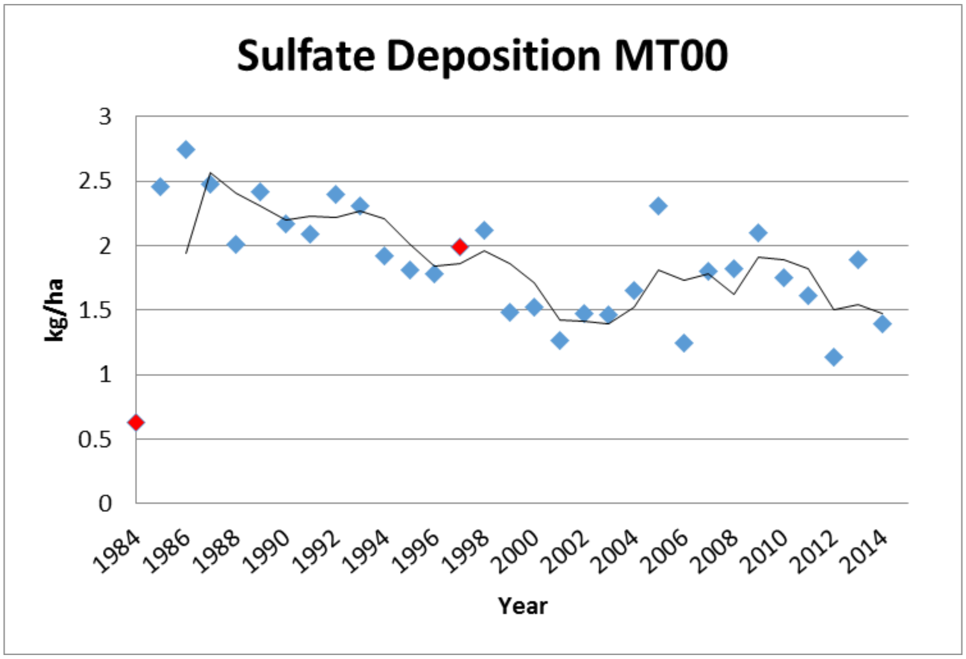

Figure 8. Sulfate wet deposition at Little Bighorn battlefield NADP site

Note: Trend line follows the 3-year average and red diamonds equal years where the annual weighted mean depositions do not meet the NADP data completeness criteria.

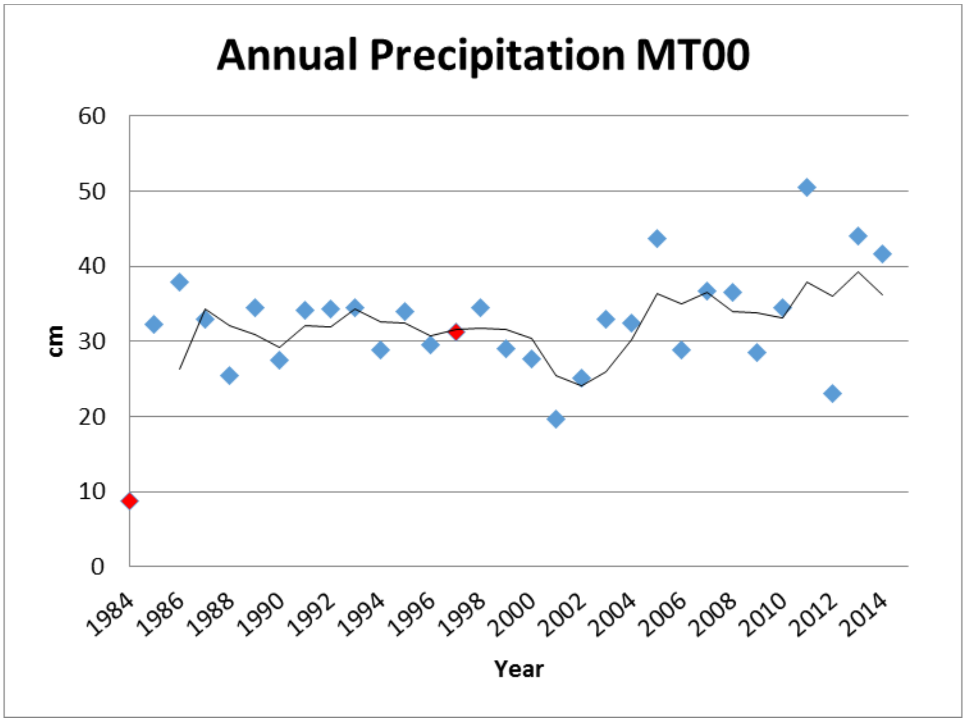

Figure 9. Annual precipitation at Little Bighorn battlefield NADP site

Note: Trend line follows the 3-year average and red diamonds equal years where the annual weighted mean depositions do not meet the NADP data completeness criteria.

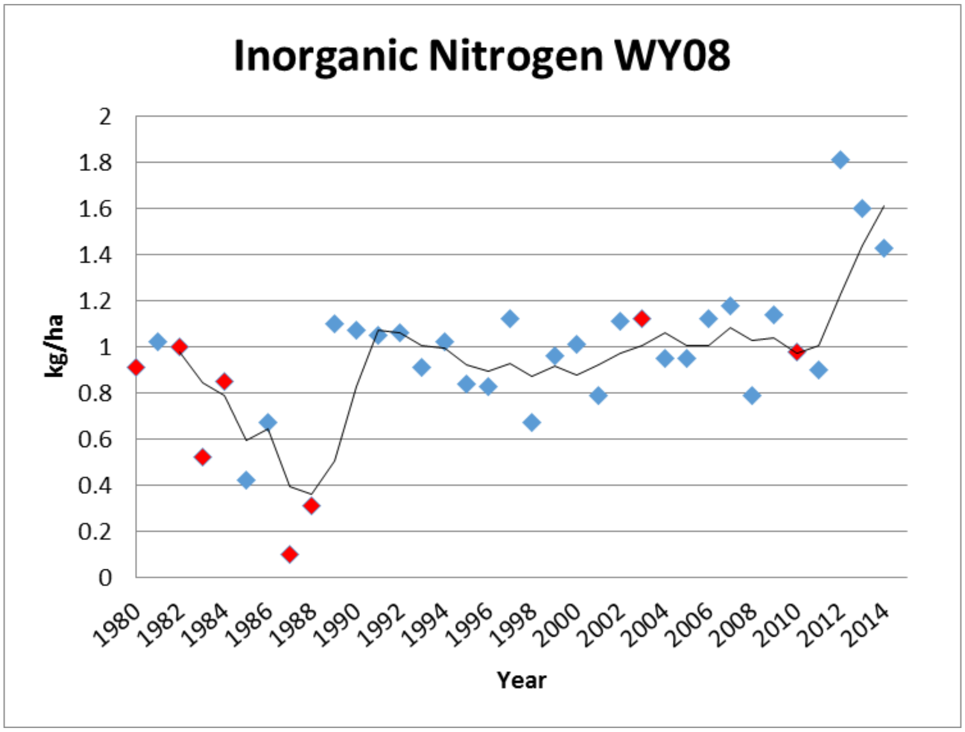

Figure 10. Inorganic wet nitrogen deposition at Tower Falls NADP site

Note: Trend line follows the 3-year average and red diamonds equal years where the annual weighted mean depositions do not meet the NADP data completeness criteria.

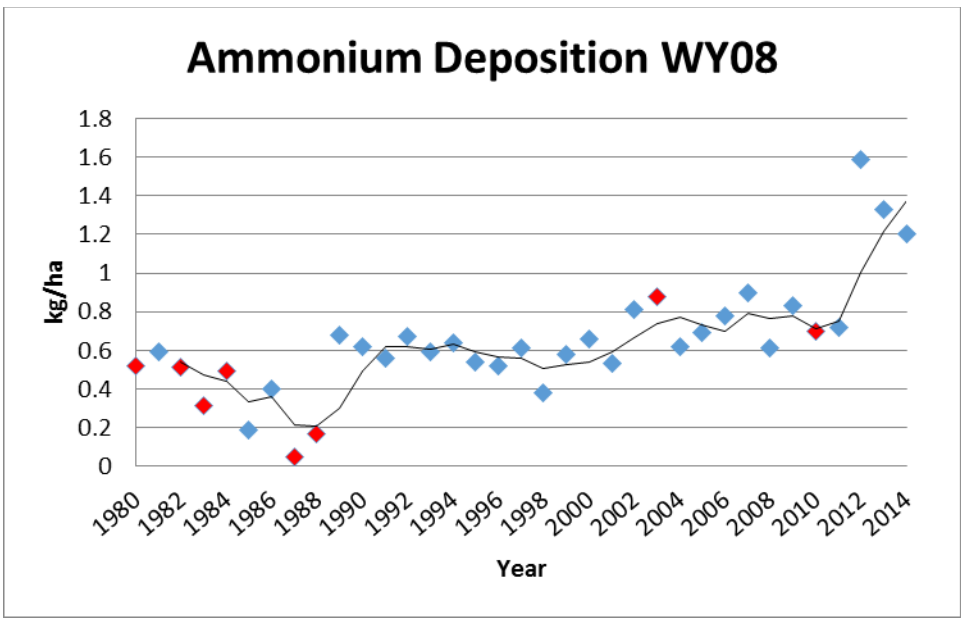

Figure 11. Ammonium wet Nitrogen deposition at Tower Falls NADP site

Note: Trend line follows the 3-year average and red diamonds equal years where the annual weighted mean depositions do not meet the NADP data completeness criteria.

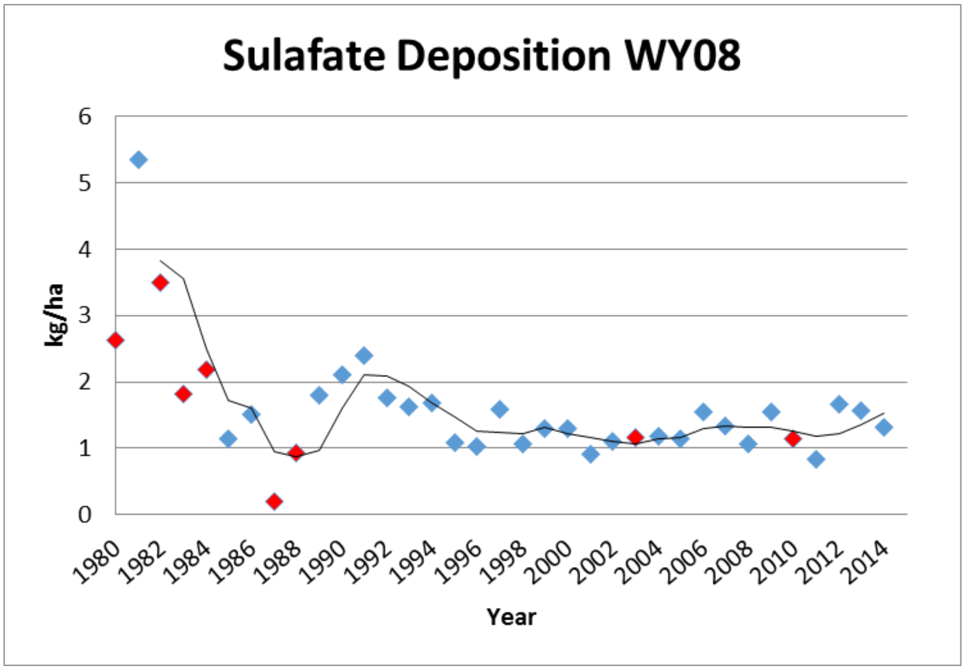

Figure 12. Sulfate wet deposition at Tower Falls NADP site

Note: Trend line follows the 3-year average and red diamonds equal years where the annual weighted mean depositions do not meet the NADP data completeness criteria.

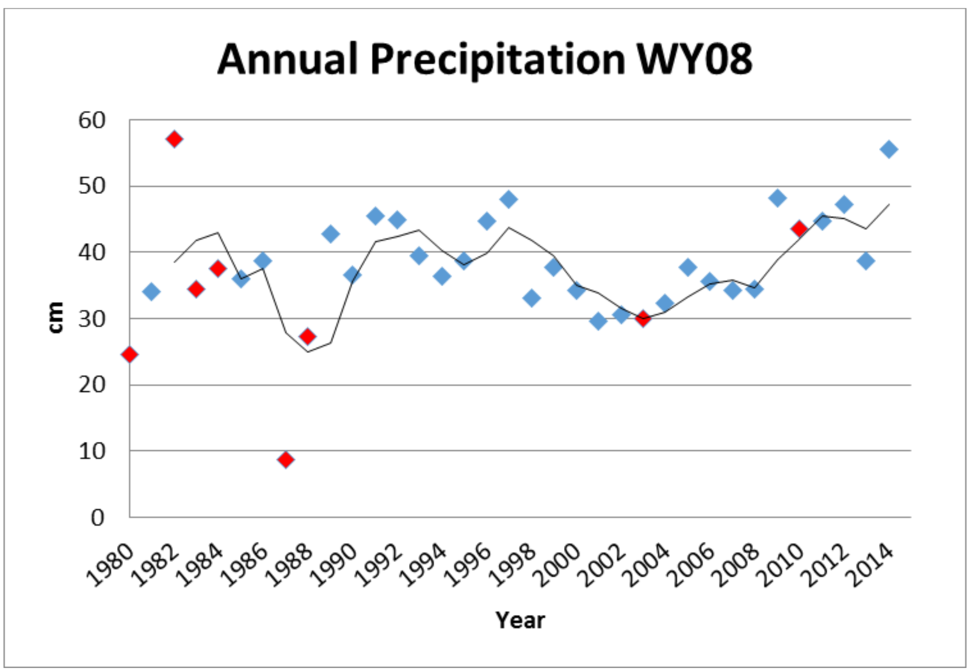

Figure 13. Annual precipitation at Tower Falls NADP site

Note: Trend line follows the 3-year average and red diamonds equal years where the annual weighted mean depositions do not meet the NADP data completeness criteria.

State Monitoring

In Montana, the Department of Environmental Quality has four monitors that share a county with the Custer Gallatin National Forest. These monitors are located in Billings, Broadus, Birney, and West Yellowstone. The monitors measure ambient concentrations of ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter of 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$) (Table 4). In South Dakota, no state monitors are located in Harding County or near the Custer Gallatin National Forest.

More about Montana's monitoring program can be found in the Montana Ambient Air Monitoring Program Quality Management Plan (2015). South Dakota's Ambient Air Monitoring Annual Plan (2015) can be found at: http://denr.sd.gov/des/aq/aqnews/Annual%20plan%202015%20Final.pdf

Table 4. Montana Department of Environmental Quality monitoring locations near (in the same county as) the Custer Gallatin National Forest

Air Pollutant	Location	Available Data	2014 (annual average)	Station ID
Ozone	Billings	2005–2007	0.59 ppm 8-hour[1]	30-111-0086
	Broadus	Current		30-075-0001
	Birney	Current		30-087-0001
CO	West Yellowstone	Current	ppm 1-hour max = 4.9 ppm	30-031-0017
NO_2	Broadus	2014	11 ppb 1-hour	30-075-0001
	Birney	2014	8 ppb 1-hour	30-087-0001
	West Yellowstone	2014	28 ppb 1-hour	30-031-0017
SO_2	Billings	1981–2014	93 ppb 1-hour	30-111-0066
PM_{10}	Broadus 2	2014	25 (µg/m^3) 24-hour	30-075-0001
	Birney 2	2014	14 (µg/m^3) 24-hour	30-087-0001
$PM_{2.5}$	Birney	Current	5 (µg/m^3)	30-087-0001
	Broadus	Current	5.3 (µg/m^3)	30-075-0001

1. 2005 to 2007.
2. The Broadus and Birney PM10 monitors are designated as special purpose monitors (SPM), and not SLAMS (State and local air monitoring stations) monitors as they do not meet appropriate sighting criteria.

In Billings there are three industry-operated SO_2 sites.

- Yellowstone Electric Limited Partnership (YELP)
- Billings Laurel Air Quality Technical Committee (BLAQTC) 30-111-2006
    - Brickyard 30-111-2005
    - Laurel 30-111-0016

Colstrip Steam Electric Generating Facility located in Rosebud County reported total lead emissions of 1.84 tons in 2014. Montana Department of Environmental Quality has a 0.5tpy monitoring threshold.

Long-term Lake Chemistry

The U.S. Forest Service Region 1 Air Monitoring Program samples sensitive lakes in high alpine wilderness areas to monitor trends in lake chemistry. Many high alpine lakes are sensitive to deposition of air pollutants because the lake water chemistry is so dilute. Two lakes sampled by the air program, Stepping Stone and Twin Island, are located in the Absaroka-Beartooth Wilderness on the Custer Gallatin National Forest. Long-term lake sampling in this wilderness started in 1993. Both lakes are sampled once annually in the centroid via raft (Story 2008).

In 2009, chemistry in both lakes was analyzed for trends (1993–2007) in acid neutralizing capacity, ammonium, nitrate, sulfate, calcium, chloride, and pH (Grenon and Story 2009). Stepping Stone showed a decreasing trend in acid neutralizing capacity and chloride while pH showed an increasing trend at both lakes (Grenon and Story 2009). Trends are currently being rerun because a change in laboratories used for analyzing lake chemistry was not accounted for in the original analysis and could have skewed the results. Only trends in acid neutralizing capacity have been rerun for Stepping Stone and Twin Island (1993–2011) and no trends were detected (McMurray [no date] (Figure 14).

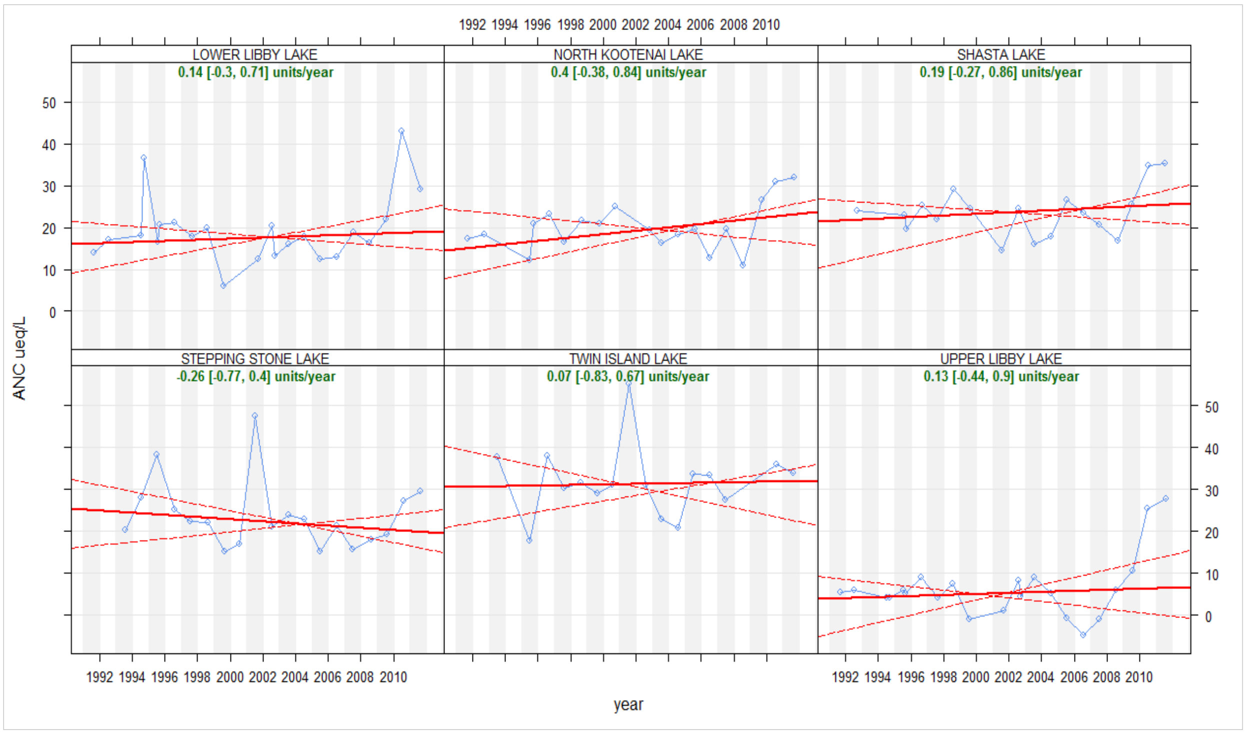

Figure 14. Acid neutralizing capacity data analyzed for all six long-term lakes in Region 1

Note: No trends were found in acid neutralizing capacity for any of the lakes. Stepping Stone and Twin Island lakes are located on the Custer Gallatin National Forest in the Absaroka-Beartooth Wilderness.

USGS Snowpack Surveys

In 1993 the USGS began snow sampling across the Rocky Mountains with the purpose of measuring total winter deposition from atmospheric pollution in snowpack. It is important to recognize that deposition amounts from this study only reflect part of the year, and therefore are not annual estimates. The program grew to 57 sites throughout the Rocky Mountains with 14 sites in the Greater Yellowstone Area, including sites on the Custer Gallatin. At each site a bulk sample of the entire snowpack is collected once per year and the snow sample is then analyzed for pollutants (nitrogen, sulfur, mercury) and major ions. Data and more information about the USGS Rocky Mountain Regional Snowpack Chemistry Monitoring Study Area can be found at http://co.water.usgs.gov/projects/RM_snowpack/.

There are three snowpack sites on the Custer Gallatin National Forest in Montana: one on top of Lion's Head outside of West Yellowstone, one at the Big Sky Ski Resort, and one at Daisy Pass outside of Cooke City. There are three snowpack sites in Yellowstone National Park: Canyon, Sylvian Lake, and Lewis Lake Divide.

Snowpack sites in the Greater Yellowstone Area had significant increasing trends in ammonium with mean concentrations higher than the regional median. The highest concentrations were on the west side of the Greater Yellowstone Area. Snowpack sites had decreasing trends in nitrate and sulfate with mean concentrations lower than the regional median. Figures 15 through 20 show 2015 nitrate, ammoniuim, and dissolved inorganic nitrogen depositon in snowpack (Sexstone 2015).

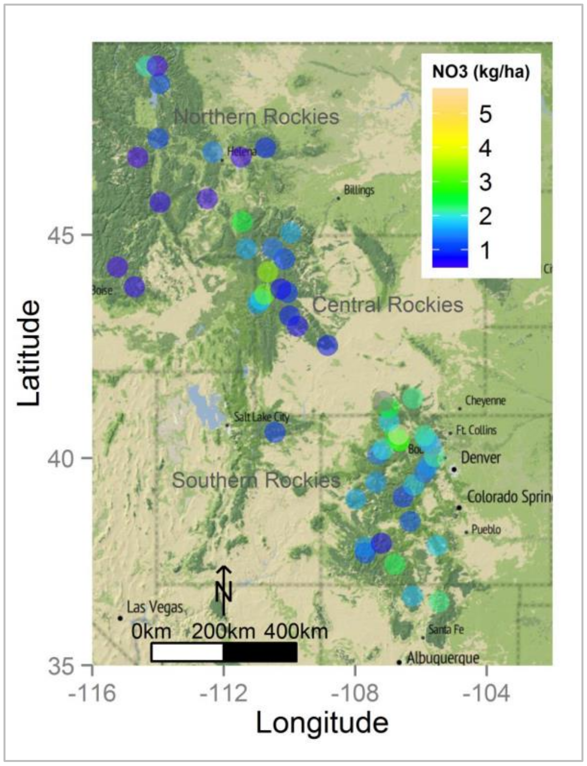

Figure 15. USGS snow sampling sites across the Rocky Mountains and the calculated nitrate deposition for winter 2015

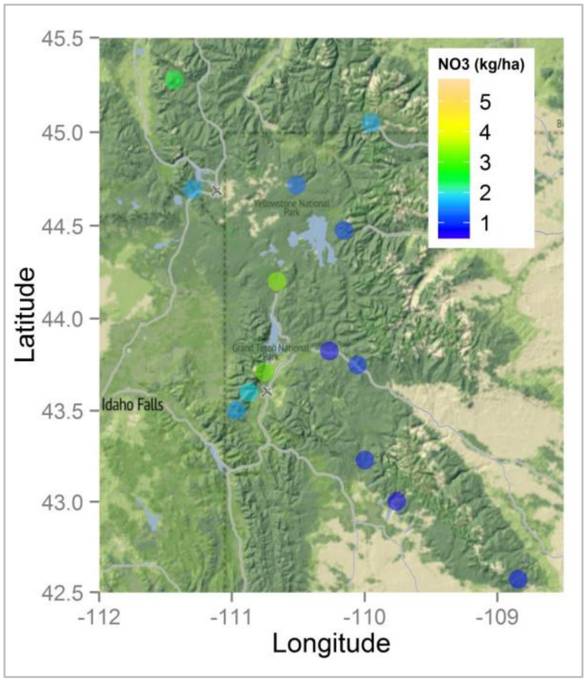

Figure 16. USGS snow sampling sites across the Greater Yellowstone Area and the calculated nitrate deposition for winter 2015

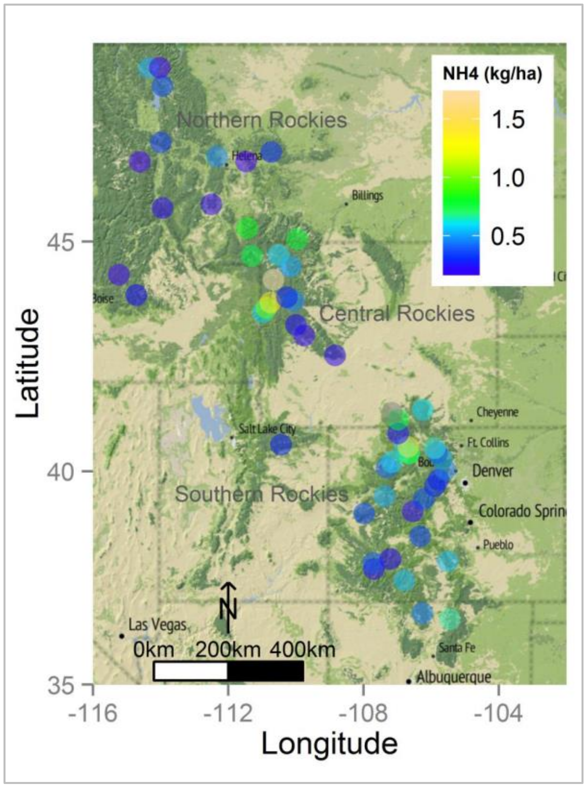

Figure 17. USGS snow sampling sites across the Rocky Mountains and the calculated ammonium deposition for winter 2015

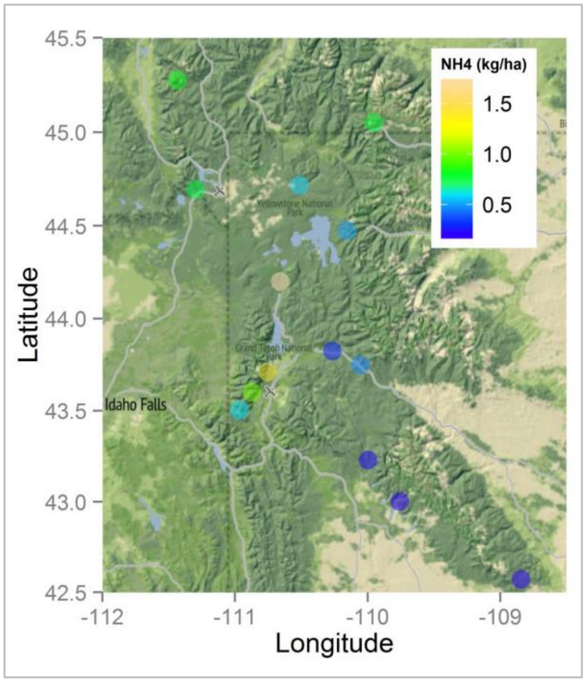

Figure 18. USGS snow sampling sites across the Greater Yellowstone Area and the calculated ammonium deposition for winter 2015

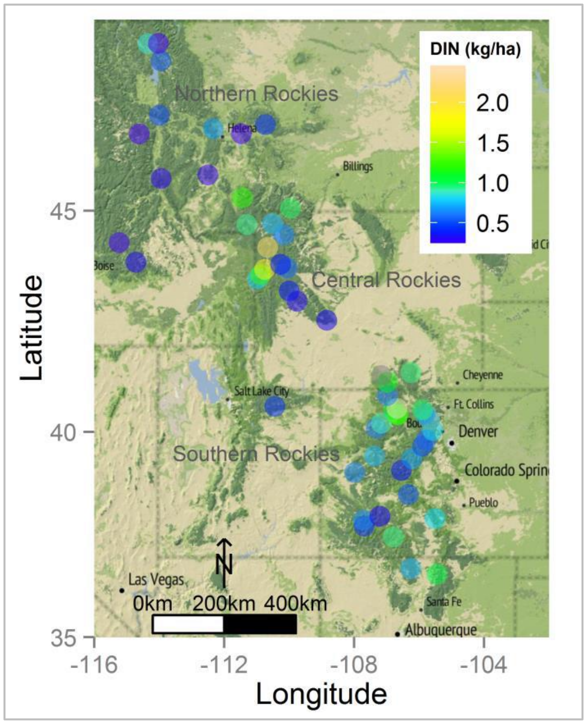

Figure 19. USGS snow sampling sites across the Rocky Mountains and the calculated total dissolved inorganic nitrogen deposition for winter 2015

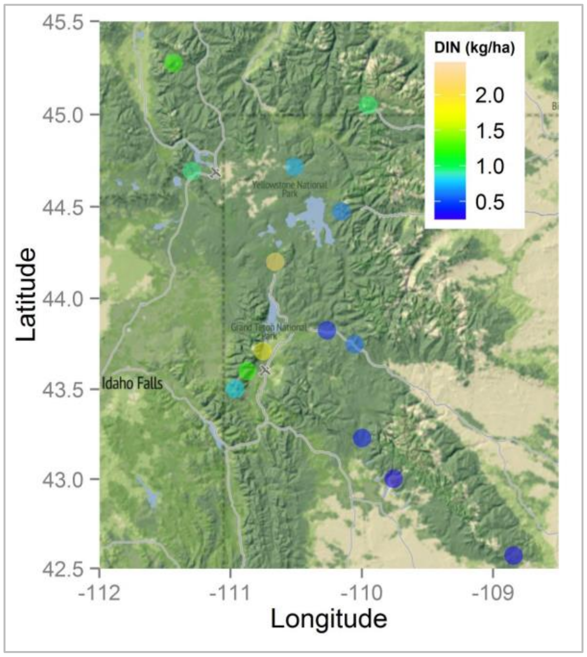

Figure 20. USGS snow sampling sites across the Greater Yellowstone Area and the calculated total dissolved inorganic nitrogen (DIN) deposition for winter 2015

Critical Loads

Each air pollutant has a residency time in the air before it precipitates out and deposits onto the earth. Deposition from pollution can negatively impact ecosystem function.

In order to protect sensitive ecosystem components critical loads have and are being developed (Pardo et al. 2011). A critical loads quantifies atmospheric deposition loading (usually in kg ha^{-1} $year^{-1}$), attaching a number to different ecosystem components, below which no harmful effect will occur (UBS 2004). The development of critical loads helps inform managers when making decisions. For example, exceedance of critical loads for nitrogen deposition have been linked to ecosystem eutrophication or acidification depending on ecosystem characteristics and the level, duration, and type of nitrogen deposition (Baron et al. 2011; Bobbink et al. 2010; Fenn et al. 2003). Eutrophication can lead to stimulation of plant and algal growth, and increased competition within biotic communities—favoring invasive species and decreasing occurrence of sensitive species (Bobbink et al. 2010; Baron 2006; Baron et al. 2011; Beem et al. 2010; Howarth 2008). The critical load for nitrogen deposition varies among different ecosystem components (Pardo et al. 2011). A Federal land manager can choose to manage for differing levels of nitrogen loading based on the critical loads for differing ecosystem components.

Nearly all the work done on critical loads in the northern Rockies has focused on nitrogen deposition. Critical loads range from 1.4 kg wet nitrogen ha^{-1} $year^{-1}$ for diatoms in sensitive high alpine lakes (Saros et al. 2011) while wet + dry nitrogen deposition above 4.0 kg ha^{-1} $year^{-1}$ has been associated with episodic freshwater acidification, lichen degradation, and changes in mineralization, nitrification, and soil chemistry of subalpine forests (Baron et al. 1994; Baron et al. 2011; Bowman et al. 2011; Fenn et al. 2003; McMurray et al. 2014; Rueth and Baron et al. 2002; Saros et al. 2011; Williams and Tonnesson 2000).

Background (pre-industrial) nitrogen deposition in the northern Rockies forested ecosystems is estimated at $\leq$ 1 Kg N ha^{-1} $year^{-1}$ (Holland et al. 1999; Sverdrup et al. 2012). Current total nitrogen(wet + dry) deposition levels in this area are estimated to be between 0.5 to 8 kg nitrogen ha^{-1} $year^{-1}$(Burns 2003; Grenon et al. 2010; McMurray et al. 2013; Nanus et al. [submitted 2016]; Yellowstone Center for Resources 2011), meaning some areas in the northern Rockies are exceeding critical loads for nitrogen deposition.

Epiphytic Lichens

Lichens are collected on the Custer Gallatin National Forest to assess trends, hotspots of deposition, and to help inform critical load estimates.

Epiphytic lichens are good indicators of current air quality conditions because they receive their nutrients primarily from the atmosphere, lack regulatory structures such as stomata and a cuticle, and are sensitive to acidifying and fertilizing pollutants (Munzi et al. 2010).

The Region 1 Air Program collects epiphytic lichens from established plots every 5 to 8 years. New plots are continuously added to fill spatial and informational gaps. Lichen collection and laboratory protocols follow Geiser (2004). There are no lichen plots east of the Beartooth Mountain Range on the Custer Gallatin National Forest.

Nitrogen deposition estimates in Figure 21 were calculated from percent nitrogen in *Letharia vulpina* following McMurray et al. (2013, 2014). These assumed near-background conditions are associated with 1.35 percent and 1.12 percent nitrogen in *U. lapponica* and *L. vulpine,* respectively. Elevated nitrogen deposition (2.0 kg nitrogen ha^{-1} year^{-1}) was associated with 1.65 percent nitrogen for *U. lapponica* and 1.35 percent nitrogen for *L. vulpina* (McMurray et al. 2014).

Percent N concentrations in lichens estimate that nitrogen deposition on parts of the Custer Gallatin National Forest are twice the estimated background amounts ($\leq$ 1 Kg nitrogen ha^{-1} year^{-1}) (Holland et al. 1999; Sverdrup et al. 2012), but lower than maximum critical loads for lichens ($\leq$ 4.0 Kg nitrogen ha^{-1} year^{-1}) (McMurray et al. 2014). These hotspots occur at lower elevations around Bozeman, Montana, and may be due in part to localized sources and common inversions (Figure 21). More work is needed to refine critical loads for lichens in the northern Rocky Mountains as 4.0 Kg nitrogen ha^{-1} year^{-1} is likely not conservative enough (McMurray et al. 2014).

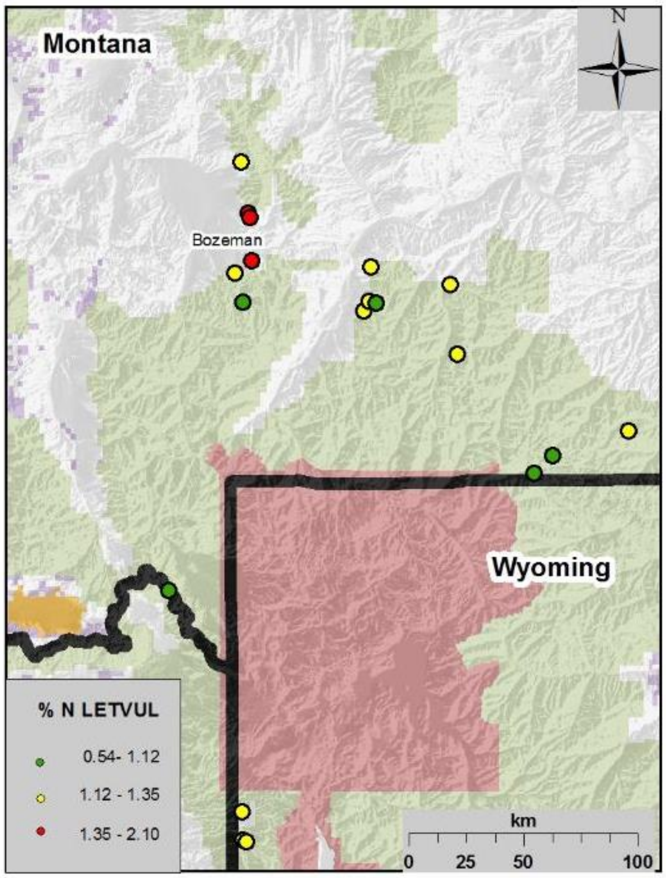

Figure 21. Percent nitrogen (N) in *Letharia vulpina*

Note: Green circles represent nitrogen deposition equal to or less than estimated background conditions: 0.9 kg nitrogen ha^{-1} yr^{-1} (Sverdrup et al. 2012). The red circles are percent nitrogen associated with twice estimated background nitrogen deposition: 2.0 kg nitrogen ha^{-1} yr^{-1}.

No critical loads for sulfur deposition have been identified for lichens in the northern Rocky Mountains. Hotspots can still be identified by looking at percent sulfur content in lichens and comparing to other plots using percentiles. Out of 92 lichen plots in the northern Rocky Mountains, 3 plots were above the 90th percentile and 4 plots were above the 80th percentile for percent sulfur content (Figure 22). The plots with the highest percent sulfur content are the same plots with the highest percent nitrogen content (mentioned above).

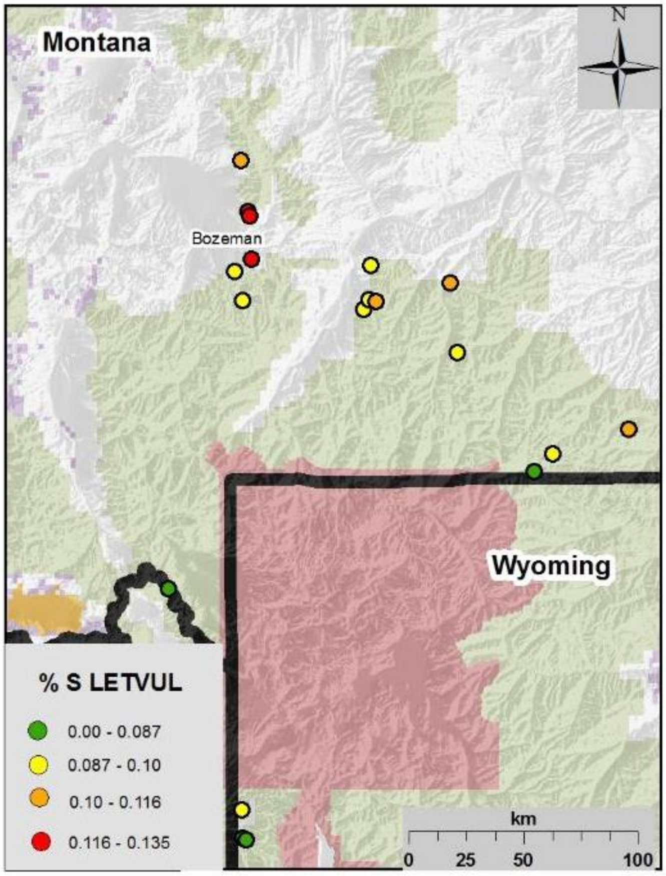

Figure 22. Percent sulfur in *Letharia vulpine*

Note: The circles represent percentiles of sulfur concentrations out of 89 plots in the northern Rockies. Green circles are plots at or below 50 percentile. Yellow circle = the 75 percentile, orange circles = 80 percentile, and red circles mark plots at or above 90 percentile.

Mercury (Hg) is also analyzed at selected plots. More research is needed to interpret what high levels of mercury in lichens might mean for surrounding ecosystems. Mercury was broken down into percentiles (n=79 plots). Two mercury hotspots exist on the Custer Gallatin National Forest and warrant further investigation and samplings (Figure 23). There are data for heavy metals and other elements, but the data has not been analyzed for hotspots or percentiles.

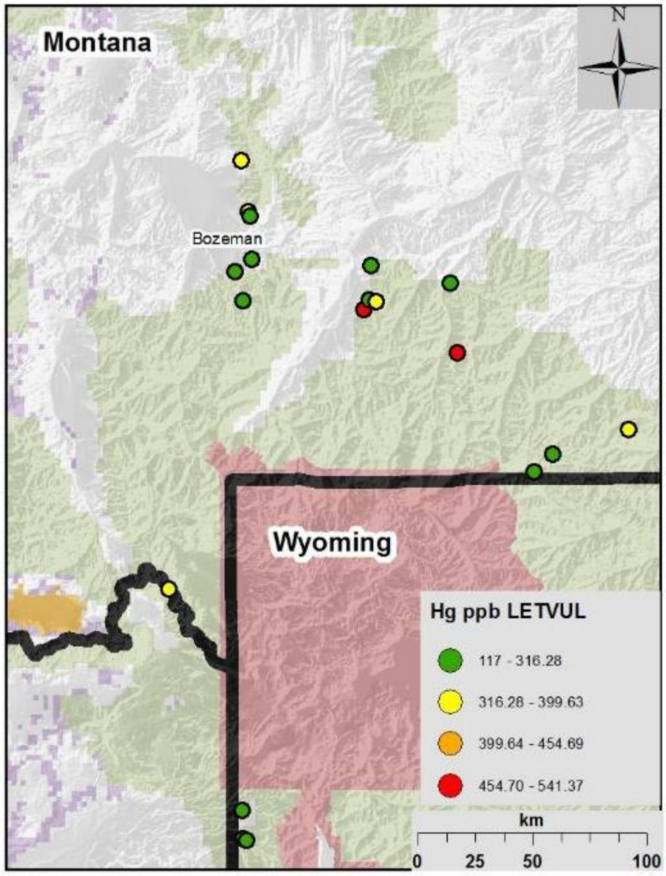

Figure 23. **Mercury (Hg) ppb in *Letharia vulpine***

Note: The circles represent percentiles of Hg ppb out of 79 plots in the northern Rockies. Green circles are plots at or below 50 percentile. Yellow circle = the 75 percentile, orange circles = 80 percentile, and red circles mark plots at or above 90 percentile.

Non-agency Research

Nitrogen Isotope Work in the Greater Yellowstone Area. Sarah Anderson, Washington State University Ph.D. candidate, found a significant increase in lichen nitrogen concentrations of herbaria specimens of *Letharia vulpina* spanning 1901 to 1996 in the Greater Yellowstone Area (https://eco.confex.com/eco/2015/webprogram/Paper55084.html). This increase in lichen content corresponded with an increase in nitrogen emissions from agriculture likely from the Snake River Plain.

Atmospheric Deposition of Nitrogen and Sulfur in the Greater Yellowstone Area. Leora Nanus, Ph.D., submitted a paper in June 2016 about her study that developed annual deposition maps and critical loads estimates in the Greater Yellowstone Area for nitrate, ammonium, and dissolved inorganic nitrogen wet deposition (at 400 meter scale). Critical Load estimates of nitrogen deposition and exceedances of critical loads for inorganic and total nitrogen deposition (wet + dry) were also mapped.

Hot spots for ammonium and total nitrogen deposition exist on the Custer Gallatin National Forest mainly in high elevations around West Yellowstone (Southern Gallatin Range) and the Beartooth Plateau. Critical load estimates for surface waters on the Custer Gallatin National Forest ranged from <1.5 to >10.0 kg ha^{-1} $year^{-1}$. The variation in range reflects differences in elevation, precipitation, and vegetation, with high alpine zones that have little buffering capacity (sparse vegetation and shallow soils) being the most sensitive. Because of this the high elevation sites have the most critical load exceedances since they are most sensitive areas to small increments of nitrogen loading. Parts of the Custer Gallatin National Forest, primarily on the Beartooth Plateau are estimated to be at critical load exceedance for surface waters. Ground-truthing of the maps is needed. Lakes on the Beartooth Plateau that are fed by glacier melt water maybe at even more risk to nitrogen critical load exceedances as glacier melt water has been found to influence nitrate concentration in streams (Saros 2010; Vandeberg and VanLooy 2016). No trends in nitrogen chemistry have been documented in the two long-term lakes monitored by the Region 1 Air Program (Grenon and Story 2009).

Trends: The Grand Teton Reactive Nitrogen Deposition Study

This study was conducted in spring and summer of 2011 with the goal of providing a more complete look at atmospheric concentration and deposition of nitrogen in and around Grand Teton National Park. Though this study takes place outside the Custer Gallatin National Forest, West Yellowstone is only 65 miles north of Driggs, Idaho, and likely affected by some of the same air masses.

The study found that ammonia was the most abundant nitrogen species measure with concentrations highest at the western most sites (Benedict et al. 2013). Changes in wet ammonium deposition have significantly increased in the Greater Yellowstone Area which points to the need to increase monitoring of ammonia.

Elevated nitric acid concentrations and deposition were found at the high elevation site on top of Grand Targhee (Benedict et al. 2013).

Transport patterns for the 10 percent highest days of ammonia showed weather patterns coming from the Snake River Plain and from the south. Further investigation using incremental probabilities showed high ammonia is associated with transport from the Snake River Valley and not northern Utah or Wyoming, whereas high NOy is associated with transport from northern Utah.

Key Benefits to People

Economy (Income, Jobs, Wealth)

One reason people visit public lands, especially national forests and national parks, is for the vistas and to breathe “fresh air”. Good air quality promotes tourism and recreation which contributes to the economy of gateway communities. Short-term air quality impacts from wildland fire smoke can have immediate negative consequences for recreation and tourism. Impacting smoke can be local or long-distance in nature. Long-term duration of poor air quality can negatively affect water bodies which can lead to degradation of drinking water, increase algal blooms, and decrease in native fisheries. Poor air quality can also negatively impact terrestrial ecosystems leading to the extirpation of rare and sensitive and native plants and the increase in invasive plants. Decrease in fisheries and increase in algal blooms negatively affect tourism and cost substantial amounts of money and resources to restore.

Quality of Life (Well-being, Health and Safety, Cultural/Traditional/Spiritual Values)

Good air quality promotes and nurtures human health. Clean air is also important for maintaining healthy plants, animals, soils, and water bodies (which are our source of drinking water). Poor air quality increases the risk of asthma, cardiovascular disease, stroke, lung cancer, and premature death (WHO Fact Sheet http://www.who.int/mediacentre/factsheets/fs313/en/).

Outdoor air pollution was estimated to cause 3.7 million premature deaths in 2012. In 2013 the International Agency for Research on Cancer (a branch of WHO) concluded that outdoor air pollution is carcinogenic. If visibility is obstructed by air pollution accidents can happen (not uncommon during periods of heavy wildland fire smoke). Poor air quality especially deposition or ambient air acidic in nature can damage cultural resources such as pictographs.

Risks and Stressors

The major risk to air quality that the Forest Service influences on the Custer Gallatin National Forest is from prescribed burns and wildland fires. Prescribed burns are controlled and regulated through the Montana/Idaho Airshed Group which targets days where weather conditions will help achieve minimal smoke impact (http://www.smokemu.org/). Short-term spikes in local particulate matter are a reality of prescribed burns. Part of the goal of prescribed burning is to help manage resources for long-term benefits and reduce the potential for abnormally large wildland fires burning in less desirable conditions. This goal also helps prevent large smoke events from wildland fire.

Trends and Drivers

The majority of air quality-related studies and analysis point towards an increasing trend in ammonium and total nitrogen deposition, especially on the western-most portion of the Custer Gallatin National Forest. This increase is likely exceeding critical loads of sensitive ecosystem components at high elevations with some localized deposition occurring around metropolitan and agricultural areas.

There are a few mercury and sulfur hotspots on the Custer Gallatin National Forest that warrant further investigation. Haze due to anthropogenic sources has decreased (increased visual range) in the Greater Yellowstone Area including the Custer-Gallatin National Forest.

Sources of air pollution depositing or impairing visibility on the Custer Gallatin National Forest include agriculture, industry, urban areas, and smoke from wildland fire and prescribed burns. Emissions sources can be both long distance and local and can contribute to either chronic or brief air quality degradation. For example, agricultural emissions come from long-distance (Snake River Plain) and local sources (applications of fertilizer, animal husbandry, and tilling fields). Smoke is typically short term and episodic in nature, whereas air pollution from the Snake River Plain is chronic.

Information Needs

Identifying critical loads for selected sensitive air quality related values would assist in revising the forest plan.

The information needs identified below would provide for more effective management of the Custer Gallatin National Forest. They are not necessary for revising the existing plans.

- More research and monitoring quantifying deposition from air pollution on the Custer Gallatin National Forest East of the Absaroka-Beartooth Range is needed.
- More monitoring and analysis is needed to assess hotspots of nitrogen and other pollutants such as sulfur, mercury, polycyclic aromatic hydrocarbons, and metals and to understand component of air pollutants released from wildland fires beyond particulate matter ($PM_{2.5}$).

- How deposition loading from air pollution in addition to changing climate interacts to put an increasing stress on resources such as high elevation plant communities, native plants, and sensitive water bodies.
- Identifying critical loads for further sensitive air quality related values and using these values to inform environmental analysis and management decisions.

Key Findings

- The existing plans for the Custer and Gallatin National Forests have very little direction for Air Quality and existing direction is not uniform.
- Both the Wilderness Act and the Clean Air Act protect sensitive Air Quality Related Values which have not been completely identified or described in the existing plans.
- Federal and state laws drive primary monitoring and assessment of air quality on the Custer Gallatin National Forest. There are no class I airsheds (class I airsheds are protected by the Clean Air Act) on the Custer Gallatin. Yellowstone National Park and the Northern Cheyenne Reservation are both class I airsheds in close proximity to the Custer Gallatin National Forest. Class II airsheds protected by the Wilderness Act include the Lee Metcalf and Absaroka-Beartooth Wilderness Areas.
- Air quality monitoring data used in the Custer Gallatin Forest Plan revision analysis includes national, state, agency, and private (universities and nonprofits) long-term networks and short-term studies.
- Analysis from monitoring networks and air quality studies indicate an increasing trend in deposition from nitrogen air pollution especially on the western most portion of the Custer Gallatin National Forest and a decreasing trend in deposition from sulfur-related air pollution.
- Critical loads quantify atmospheric deposition loading (usually in kg ha^{-1} $year^{-1}$), attaching a number to different ecosystem components, below which no harmful effect will occur (UBS 2004). The development of critical loads helps inform managers when making decisions.
- Recent studies indicate that nitrogen deposition is exceeding critical loads of sensitive ecosystem components at high elevations with some localized deposition occurring around metropolitan and agricultural areas in the Greater Yellowstone Area including parts of the Custer Gallatin National Forest. Research is ongoing.
- Haze due to anthropogenic (non-fire) sources has decreased (increased visibility) in the Greater Yellowstone Area.
- The Custer Gallatin National Forest will continue to coordinate with Montana Department of Environmental Quality and other participating agencies and organizations to minimize impacts from smoke in all fire management activities.

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